

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

COMPLETE LISTING OF CLAIMS:

Claims 1-38 : (Canceled)

Claim 39 : (New) A variable frequency tag, comprising:

a) interfacing means for receiving interrogating radiation at the tag and generating a corresponding received signal, and for receiving a signature signal and radiating corresponding response radiation;

b) processing means for receiving the received signal and outputting the signature signal in response, the signature signal including a signature code for use in identifying the tag;

c) clocking means for controlling a rate at which the signature code is output;

d) power supplying means for providing an electrical potential difference for energizing the tag; and

e) the clocking means being operable to output the signature code at a rate which is governed by a magnitude of the received signal.

Claim 40 : (New) The tag according to claim 39, wherein the clocking means includes first and second oscillators, the first oscillator being operable to clock the processing means, and the second oscillator being operable to control a frequency at which the signature code is output from the tag in response to the magnitude of the received signal.

Claim 41 : (New) The tag according to claim 40, wherein the first oscillator is arranged to oscillate at a substantially constant frequency.

Claim 42 : (New) The tag according to claim 39, wherein the supplying means is coupled to the interfacing means, the supplying means being operable to derive the potential difference from the received signal.

Claim 43 : (New) The tag according to claim 42, wherein the supplying means includes a transformer for enhancing the potential difference applied to the clocking means and the processing means.

Claim 44 : (New) The tag according to claim 43, wherein the transformer is a piezo-electric transformer.

Claim 45 : (New) The tag according to claim 44, wherein the transformer includes a multilayer primary region arranged to be driven by the received signal, and a single-layer secondary region at which the potential difference is generated, the primary and secondary regions being mechanically coupled.

Claim 46 : (New) The tag according to claim 39, wherein the supplying means includes potential difference limiting means for preventing excess supply potential damage to the processing means and the clocking means.

Claim 47 : (New) The tag according to claim 39, wherein the interfacing means comprises an antenna assembly operable to generate the response radiation from the received radiation by modulating reflectivity of the antenna assembly depending upon tag power consumption.

Claim 48 : (New) The tag according to claim 39, wherein the interfacing means comprises an antenna assembly operable to generate the response radiation from the received radiation by modulating reflectivity of the antenna assembly, the processing means being connected in direct communication with the antenna assembly for modulating the reflectivity of the antenna assembly with the signature code.

Claim 49 : (New) The tag according to claim 39, wherein the clocking means is operable to clock the processing means at a rate which increases as the potential difference increases.

Claim 50 : (New) The tag according to claim 49, wherein the clocking means is operable to increase the rate at which the processing means is clocked in a stepwise manner in response to increase in the potential difference.

Claim 51 : (New) The tag according to claim 50, wherein the clocking means comprises digital dividing means for dividing a master clock signal to generate a clocking signal for clocking the processing means, the master clock signal being derived from the received signal.

Claim 52 : (New) The tag according to claim 50, wherein the clocking means comprises digital dividing means for dividing a master clock signal generated by oscillating means, the master clock signal being substantially constant in operation.

Claim 53 : (New) The tag according to claim 49, wherein the clocking means is operable to increase the rate at which the processing means is clocked in a substantially linear manner in response to increase in the potential difference.

Claim 54 : (New) The tag according to claim 49, wherein the clocking means is operable to increase the rate at which the processing means is clocking in a substantially logarithmic manner in response to increase in the potential difference.

Claim 55 : (New) The tag according to claim 49, wherein the clocking means includes an oscillator comprising a plurality of serially connected logic gates with feedback therearound for generating a clocking signal for clocking the processing means, the logic gates having a signal propagation therethrough which is a function of the potential difference.

Claim 56 : (New) The tag according to claim 55, wherein the oscillator comprises ring-of-three logic gates configured with feedback therearound for generating the clocking signal.

Claim 57 : (New) The tag according to claim 39, wherein the processing means is operable to dissipate a majority of power required to operate the tag.

Claim 58 : (New) The tag according to claim 39, wherein the processing means is operable to output the signature code repetitively with pause intervals therebetween during which the code is not output.

Claim 59 : (New) The tag according to claim 58, wherein one of the pause intervals corresponds to at least 90% of an interval at which the signature code is output.

Claim 60 : (New) The tag according to claim 39, wherein the processing means is receptive to at least one synchronization pulse in the received signal and is switchable to a temporary wait state in which the processing means does not output its signature code when the at least one synchronization pulses does not align to a synchronization time window after the tag outputs its signature code.

Claim 61 : (New) The tag according to claim 39, wherein the processing means includes CMOS logic circuits for generating the signature code, the logic circuits being operable to consume increasing power in operation as their clocking rate is increased.

Claim 62 : (New) An interrogating device for interrogating at least one variable frequency tag, the device comprising:

- a) signal generating means for generating an interrogating signal;
- b) interrogation interfacing means for radiating the interrogating signal as interrogating radiation towards the at least one tag, and for receiving response radiation from the at least one tag and generating a corresponding response signal; and
- c) signal processing means for filtering the response signal and thereby isolating signal spectral components from the at least one tag and extracting signature codes from the signal components for identifying the at least one tag.

Claim 63 : (New) The device according to claim 62, wherein the interrogation interfacing means comprises a directional antenna assembly for interrogating the at least one tag from a plurality of relative angles, and the signal processing means is operable to process response signals arising at the device for the plurality of relative angles to determine bearing of the at least one tag with respect to the device.

Claim 64 : (New) An interrogating device for interrogating at least one variable frequency tag, the device comprising:

- a) signal generating means for generating an interrogating signal comprising an excitation component for exciting at least one transformer of the at least one tag into resonance;

b) interrogation interfacing means for radiating the interrogating signal as interrogating radiation towards the at least one tag, for exciting the at least one transformer into resonance for generating an enhanced potential signal within the at least one tag, and for receiving response radiation from the at least one tag and generating a corresponding response signal; and

c) signal processing means for filtering the response signal and thereby isolating signal spectral components from the at least one tag and extracting signature codes from the signal components for identifying the at least one tag.

Claim 65 : (New) The device according to claim 64, including means for frequency sweeping the excitation component in frequency for at least one of operating the at least one tag at resonance of at least one transformer, and resolving contention between simultaneously responding tags.

Claim 66 : (New) The device according to claim 64, including tag transporting means for transporting in operation the at least one tag spatially in relation to the interrogation interfacing means, the signal processing means being operable to sample the response signal repetitively at intervals for resolving multiple tag contention.

Claim 67 : (New) The device according to claim 64, wherein the interrogation interfacing means comprises a plurality of antennas spatially disposed in relation to the at least one tag for radiating the interrogating radiation, the signal processing means being operable to switch in sequence through the antennas to interrogate the at least one tag from varying distances, and to process corresponding response signals at the device for resolving multiple tag contention.

Claim 68 : (New) A tagging system incorporating at least one variable frequency tag; and a device for interrogating and identifying the at least one tag.

Claim 69 : (New) A method of interrogating a variable frequency tag using an interrogating device, the method comprising the steps of:

- a) emitting interrogating radiation from the device towards the tag;
- b) receiving the interrogating radiation at the tag and generating a corresponding received signal;
- c) receiving the received signal at processing means of the tag;
- d) outputting a signature signal from the processing means in response to receiving the received signal thereat, the signature signal including a signature code for use in identifying the tag, the signature code being output at a rate dependent upon a supply potential difference energizing the tag;
- e) radiating the signature signal as response radiation from the tag;
- f) receiving the response radiation from the tag at the device and generating a corresponding interrogation received signal thereat; and
- g) filtering the interrogation received signal in the device to isolate at least one spectral component corresponding to the tag, extracting the signature code of the tag from the at least one spectral component, and then correlating the signature code with at least one signature template to identify the tag.

Claim 70 : (New) The method according to claim 69, and deriving the supply potential difference from the received signal.

Claim 71 : (New) The method according to claim 70, and enhancing the supply potential difference by using a piezo-electric step-up transformer.

Claim 72 : (New) The method according to claim 71, wherein the interrogating radiation includes a component for exciting the transformer into vibration, the method involving sweeping the component in frequency for determining when the tag is operating at resonance of its transformer.

Claim 73 : (New) A method of resolving contention between a plurality of variable frequency tags interrogated from an interrogating device, the method comprising the steps of:

- a) emitting interrogating radiation from the device towards the tags;
- b) receiving the interrogating radiation at each tag and generating a corresponding received signal thereat;
- c) receiving at each tag the received signal at processing means of the respective tag;
- d) outputting a signature signal from the processing means of each tag in response to receiving the received signal thereat, the signature signal including an associated signature code for use in identifying the respective tag, the signature code being output at a rate dependent upon a supply potential difference energizing the respective tag, the potential difference being derived from the received signal of the respective tag;
- e) radiating the signature signal of each tag as response radiation from the respective tag;
- f) receiving the response radiation from the tags at the device and generating a corresponding interrogation received signal thereat;

g) filtering the interrogation received signal at the device to isolate at least one spectral component corresponding to the tags, extracting the signature codes of the tags from the at least one spectral component, and then correlating the signature codes with at least one signature template for identifying the tags; and

h) if contention exists with respect to at least one of the spectral components, repetitively modifying a spatial relationship between the device and the tags and repeating steps a) to g) until the contention is resolved.

Claim 74 : (New) A method of resolving contention between a plurality of variable frequency tags interrogated from an interrogating device, the method comprising the steps of:

- a) emitting interrogating radiation from the device towards the tags;
- b) receiving at each tag the interrogating radiation and generating a corresponding received signal thereat;
- c) receiving at each tag the received signal at processing means of the respective tag;
- d) outputting a signature signal from the processing means of each tag in response to receiving the received signals thereat, the signature signal including an associated signature code for use in identifying the respective tag, the signature code being output at a rate dependent upon a supply potential difference energizing the respective tag, the potential difference being derived from the received signal of the respective tag, the signature code being output repetitively with pauses therebetween during which the code is not output;

- e) radiating the signature signal of each tag as response radiation from the respective tag;
- f) receiving the response radiation from the tags at the device and generating a corresponding interrogation received signal thereat;
- g) filtering the interrogation received signal at the device to isolate at least one spectral component corresponding to the tags, extracting the signature codes of the tags from the at least one spectral component, and then correlating the signature codes with at least one signature template for identifying the tags; and
- h) if contention exists with respect to at least one of the spectral components, repeating steps a) to g) until the contention is resolved.

Claim 75 : (New) A method of resolving contention between a plurality of variable frequency tags interrogated from an interrogating device, the method comprising the steps of:

- a) emitting interrogating radiation from the device towards the tags;
- b) receiving the interrogating radiation at each tag and generating a corresponding received signal thereat;
- c) receiving at each tag the received signal at processing means of the respective tag;
- d) identifying at least one pulse present in the received signal at each tag, outputting an associated signature signal from the processing means of the respective tag in response to receiving the received signal thereat depending on whether or not the at least one pulse is coincident with a time window associated with the respective tag, the signature signal including an

associated signature code for use in identifying the respective tag, each signature code being output at a rate dependent upon a supply potential difference energizing the respective tag, the potential difference being derived from the received signal of the respective tag;

e) radiating the signature signals as response radiation from at least one of the tags;

f) receiving the response radiation from the at least one tag at the device and generating a corresponding interrogation received signal thereat;

g) filtering the interrogation received signal at the device to isolate at least one spectral component corresponding to the at least one tag, extracting the signature codes of the at least one tag from the at least one spectral component, and then correlating the signature codes with at least one signature template for identifying the at least one tag; and

h) if contention exists with respect to at least one of the spectral components, outputting the at least one pulse in the interrogating radiation to temporarily disable at least one of the tags from responding and repeating steps a) to g) until the contention is resolved.

Claim 76 : (New) The method according to claim 75, wherein a time window of each tag is temporally dependent upon a clocking rate at which the processing means of the at least one tag is clocked, the clocking rate in turn being dependent upon the supply potential difference of the respective tag.